

OTTER BROOK LAKE
KEENE AND ROXBURY, NEW HAMPSHIRE

FOREST MANAGEMENT PLAN
MASTER PLAN APPENDIX B
AND
FISH AND WILDLIFE MANAGEMENT PLAN
MASTER PLAN APPENDIX D

Department of the Army
New England Division, Corps of Engineers
Operations Division
Waltham, Massachusetts 02254

March 1982

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Acting Chief, Operations Division

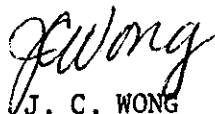
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21 July 1982

CMT 1

Mr. Mitchell/lr/284

1. The subject appendices, prepared in accordance with ER 1130-2-400, dated May 1971, has been approved by the Division Engineer.
2. The plan has been developed to increase the value of reservoir lands for recreation and wildlife, and to promote natural ecological conditions by following accepted conservation practices.
3. This plan has been developed in coordination with the U.S. Fish and Wildlife Service, the New Hampshire Fish and Game Department and should serve as an informational copy.



J. C. WONG

Acting Chief, Operations Division

Incl
as

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Master Plan Appendices B & D, Forest and Fish and Wildlife Management Plan, Otter Brook Lake

TO Division Engineer

FROM Acting Chief, Operations Division

DATE 1 June 1982

CMT 1

Mr. Mitchell/lr/305

1. Inclosed for your approval is the Forest and Fish and Wildlife Management Plan for Otter Brook Lake. This plan will serve as Appendices B and D to the Master Plan for this project.

2. It has been prepared in conjunction with ER 1130-2-400, dated 28 May 1971. It has been reviewed by NED Planning and Real Estate Divisions; and the New Hampshire Fish and Game Department and the New Hampshire Department of Resources and Economic Development.

3. Division Engineers have been designated as approval authority for these plans by ER 1130-2-400. Information copies are to be forwarded to OCE upon approval.

Incl
as

J. C. Wong
J. C. WONG

Acting Chief, Operations Division

NEDDE

TO Chief, Operations Division

FROM Division Engineer

DATE *20 July 82* CMT 2

☒

APPROVED

☐

DISAPPROVED

C. E. Edgar III

C. E. EDGAR, III
Colonel, Corps of Engineers
Division Engineer

OTTER BROOK LAKE
KEENE AND ROXBURY, NEW HAMPSHIRE

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Department of the Army
New England Division, Corps of Engineers
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Waltham, Massachusetts 02254

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Mark Rosenthal -- Park Ranger, UCRB

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SECTION 1. INTRODUCTION

Purpose

This plan sets forth a maintenance and enhancement program for the forest, fish and wildlife resources at Otter Brook Lake. Implementation of this plan will primarily provide for wise usage and minimal waste of the present natural resources.

Authority

This natural resources management plan complies with the requirements for Master Plan Appendices B (Forest Management Plan) and D (Fish and Wildlife Management Plan) as set forth in ER 1130-2-400, dated 28 May 1971.

Management Objectives

This plan will provide a working format of management practices to maintain and enhance the forest, fish, and wildlife resources indigenous to the area with sustained consumptive and non-consumptive uses of those resources.

Coordination

This plan has been coordinated with the New Hampshire Fish and Game Department, the New Hampshire Department of Resources and Economic Development, the U.S. Fish and Wildlife Service, and several private groups concerned with natural resources management on public lands.

SECTION 2. PROJECT DESCRIPTION

Location

Otter Brook Lake is located in the city of Keene and the town of Roxbury, Cheshire County, New Hampshire. The dam is located in the southwestern part of the state approximately 2.5 miles east of Keene on NH State Highway 101 then 2 miles north on Branch Road.

Acquisition

Otter Brook Lake is a unit of the comprehensive plan for flood control in the Connecticut River Basin. Authorization for the project is contained in the Flood Control Act of 1954 (Public Law 780, 83rd Congress). Project construction began in September, 1956, and was completed in January, 1959.

General

The reservoir area consists of a total of 458 acres of fee-owned land. The permanent pool covers 90 acres. Land area available for terrestrial management totals about 350 acres with approximately 276 forested acres.

Table 1 (Exhibit A) shows the elevations at various pool stages.

History

Land in the area of the dam was formerly woodland and pasture, while the land in the recreation area was principally farmland with a few overnight cabins near the present picnic area.

Topography

The general topography of the reservoir valley is steep-sided and narrow. The valley floor is about 300 feet wide at the dam and about 1,200 feet wide at the upstream end of the permanent pool. The hills on the east side of the reservoir reach an elevation of 1,400 feet NGVD.

Climate

The area's climate is variable and characterized by frequent but generally short periods of heavy precipitation during the summer months and longer periods of less intense precipitation during the winter months. Precipitation is fairly well distributed over the whole year and amounts to about 40 inches annually. Snowfall totals about 67 inches per year.

Winters are moderately severe with below 0°F temperatures being common. Summers are mild with temperatures infrequently going over 95°F.

Geology and Soils

The soils and geology of Otter Brook Lake were reshaped and formed during the recession of the last Laurentide ice sheet approximately 15,000 years ago. Glaciofluvial deposits in the form of kames and outwash deposits left by glacial melt waters are common. Soils here are in the Gloucester-Merrimack series. They are hilly to fairly level, somewhat excessively to excessively drained, sandy and gravelly in texture and has in buffering ability (USDA, SCS 1974).

A soils map is an excellent addition to the array of resources management tools. With the aid of a soils suitability guide, a soils map can provide information with which the feasibility of management practices can be checked before implementation.

The soils at this reservoir were mapped in 1937 and updated in 1981. Soils data are available from the Keene, New Hampshire, office of the Soil Conservation Service. This data should be consulted during the planning stage of any land management program.

SECTION 3. AREA CLASSIFICATION

Forest Land

Otter Brook Lake has approximately 276 acres of forested land. the principle cover types are white pine - northern red oak - white ash (Pinus strobus - Quercus rubra - Fraxinus americana), sugar maple - beech - yellow birch (Acer saccharum - Fagus grandifolia - Betula alleghaniensis), white pine - hemlock (Tsuga canadensis), northern red oak - basswood (Tilia americana) - white ash, gray birch - red maple (Betula populifolia - Acer rubrum), and aspen (Populus spp.).

Open Land

Open lands at this reservoir are associated primarily with the project administration area, the recreation area, old fields, and borrow areas.

Open lands in the administration and recreation areas are maintained by frequent mowings. Most of the old fields are in various stages of growing into brush.

Recreation Area

Otter Brook Lake Recreation Area is located at the north end of the pool and consists of 70 picnic tables, 35 fireplaces, a beach, restrooms, changehouse, one boat ramp, and parking for about 450 cars. The remainder of the reservoir is open to dispersed recreational activities such as hiking, hunting, fishing, and nature photography and observation. During the winter, the reservoir lands are used by snowmobilers, snowshoers, and cross-country skiers.

Aesthetic Areas

The top of the dam is the overlook area for the reservoir and the downstream area. Parking is available near the flagpole on the west end of the dam and at the pull-off north of the east end of the dam.

Fish and Wildlife Management Areas

Specific fish and wildlife management areas are the whitetail deer (Odocoileus virginianis) wintering area, the permanent pool, the wetlands in the recreation area, old fields, the river and streams upstream of the permanent pool, and the river downstream of the dam. These areas will be managed to primarily benefit indigenous fish and wildlife species.

SECTION 4. FOREST RESOURCES

Forest Compartments

To facilitate management of Otter Brook Lake's forest resources, the 276 forested acres have been divided into two compartments. Compartment 1 covers reservoir lands east of the river channel, and compartment 2 contains the lands on the west side of the river channel.

Forest Types

Forest cover types were determined using Forest Cover Types of North America, published by the Society of American Foresters (see Exhibit C).

Cover types, from largest to smallest, are hemlock, sugar maple-beech-yellow birch, white pine, white pine-northern red oak-white ash, northern red oak-basswood-white ash, aspen, gray birch-red maple, and eastern white pine-European larch plantation.

Forest Inventory

In 1981, a 3% timber inventory was conducted using a calibrated wedge prism with a basal area factor of 10. Sample plots were chosen at random using a random numbers table. Volumes were determined at the 90% confidence level.

Hardwood species sampled were apple (Pyrus malus), white ash, American beech, red maple, sugar maple, and northern red oak. Eastern hemlock and eastern white pine comprised the softwood compartment of the inventory.

The total estimated volume for the reservoir is 2,267,402 board feet with volumes per acre ranging from 27,871 board feet per acre for eastern white pine to 84 board feet per acre for white ash. See Table 2 (Exhibit A) for volume data.

A harvest of approximately 200,000 board feet of white pine will be removed in 1982. This material will come from the pine stand north of the recreation area. The basal area of the stand exceeds 250 sq. ft.; quality and access is considered good.

SECTION 5. AQUATIC WILDLIFE RESOURCES

General

The lifeblood of an aquatic ecosystem is the water itself. It is the medium that provides cover, physical support, temperature regulation, and all the other necessary elements of aquatic life. Therefore, it is essential that the limnological characteristics be available to those attempting to manage the aquatic ecosystem. The individuals responsible for the implementation of this management plan must avail themselves of all available data from the NED Water Quality Laboratory, the State of Vermont, and any other data sources. If necessary, additional field studies should be conducted for the express purpose of implementing this plan.

The management of the aquatic community begins with the recognition of the major indigenous species. A good management program gives consideration to all indigenous species whether they are residents, transients, or (in some special cases) incidentals. Usually, an incidental species will only be given consideration if it is threatened or endangered. The interrelationships of all species must be considered before any management practices are implemented.

Warm Water Fishery

For warm water fish in New Hampshire, the major danger is overpopulation. Most warm water species are prolific spawners, and overpopulation results in stunted growth. Therefore, stocking should be unnecessary, except to create a new warm water fishery. This type of stocking should be tried only after biological data have been collected and analyzed and there is proof that a niche is available for the species elected for stocking.

In 1979, three 30 foot sections of 2 inch stretched measure gill nets were set for four nights to sample the fish in the pool. A total of 74 fish of seven species were caught. Chain pickerel (Esox niger), brown bullhead (Ictalurus nebulosus), and yellow perch (Perca flavescens) accounted for 51.4 percent, 28.4 percent, and 13.5 percent of the captures, respectively. The other species caught were golden shiner (Notemigonus crysoleucas), sunfish (Lepomis sp.), white sucker (Castostomus commersoni), and fallfish (Semotilus corporalis). Data for this survey is summarized in Table 3 (Exhibit A).

In 1980, four fish surveys were conducted using different gear types of each survey. Standard minnow traps were set at various times from July through September. One trap net with a leader and two wings was set at various times in July and August. Two-inch stretched measure gill nets (30 foot sections) were set at various times from August through early October. One 30 foot section of 1 inch stretched measure gill net was set at various times from August through early October. No records were kept on total number of nights each type of gear was used.

The minnow traps caught 69 fish of four species. Captures were spaced over 18 nights. The species caught were yellow perch, golden shiner, pumpkinseed (Lepomis gibbosus), and fallfish.

The trap net caught 29 fish of five species spaced over eight nights. The species caught were chain pickerel, yellow perch, fallfish, white sucker, and rock bass (Ambloplites rupestris). Snapping turtles (Chelydra serpentina) and eastern painted turtles (Chrysemys picta picta) were also caught in the trap net but not on the same nights as any of the fish.

The 2-inch stretched measure gill nets caught 78 fish of seven species spaced over 11 nights. Usually, two 30 foot sections were set at the same time. The species caught were chain pickerel, white sucker, pumpkinseed, yellow perch, brown bullhead, fallfish, and rock bass.

The 1-inch stretched measure gill net caught 162 fish of six species spaced over 14 nights. The species caught were golden shiner, yellow perch, fallfish, chain pickerel, common shiner (Notropis cornutus), and pumpkinseed.

Data from these surveys are summarized in Table 4 (Exhibit A).

Chain pickerel are fish of quiet, shallow water. They frequent areas of aquatic vegetation where they lie concealed waiting for prey. They are primarily piscivorous as adults, feeding on insects and small crustaceans when young. Preferred water temperatures are between 80°F and 90°F. Pickerel spawn in early spring after ice-out. Their chief importance in New Hampshire is during the icefishing season.

The yellow perch and chain pickerel are the two major fish carnivores at Otter Brook. Perch can attain a size of 12 inches and some fairly large ones were taken out of the impoundment during the 1980 sampling period. They favor lakes where weeds are present and the quiet portions of large streams. Yellow perch are good game fish, easy to catch and good to eat. At Otter Brook, they are fished primarily in the winter, through the ice. They spawn in late spring and feed upon small fishes, aquatic insects, and small crustaceans. Care must be taken not to allow them to become overabundant or else stunting will occur.

The golden shiner occupies habitat much the same as chain pickerels. Females may spawn more than once during the breeding season which extends for several months. Golden shiners eat a wide variety of food, from microscopic plants and animals to small mollusks and occasional fish. Its primary importance lies as a forage fish for larger game species such as bass and pickerel.

The fallfish is another common minnow distinguished by the large size it can attain -- up to 16 inches long and a weight of two to three pounds. It inhabits lakes, streams and rivers. It is used as food by many game fishes, but when large, it will feed on the young of such species as smallmouth bass. It also competes with trout and bass for such food items as insects and crayfish. The fallfish is used as bait by fishermen.

The pumpkinseed can be found in the quiet waters of most of New Hampshire's ponds, lakes and streams, especially where abundant aquatic vegetation can be found. Their flesh is good tasting, and when they reach a large enough size (seven to nine inches), they make a good panfish. Pumpkinseeds can present a major problem to the management of largemouth and smallmouth bass when they are present in sufficient numbers for stunting to occur. This situation is frequently encountered because fishing pressure on pumpkinseeds is low. As a result, the bass population suffers through competition for food and nesting space by having its young preyed upon.

The white sucker inhabits virtually all freshwater habitats and is almost universally present in New Hampshire's water bodies. It is a bottom fish, feeding on both animal and plant matter. The flesh of suckers is good tasting if they are caught in the spring. They are also used as a bait fish -- larger ones are sold as cut bait and small ones make a long-lasting live bait. White suckers also serve as a food source for many game fish.

The brown bullhead inhabits lakes, ponds, and slow-moving sections of rivers and streams. It is one of the hardiest of our native fish, able to survive periods of drought by burying itself in the mud and respiring through its skin. Its air bladder can also function as a "lung" so that atmospheric air can be utilized in an emergency. With these respiratory system modifications, bullheads can survive for a period of weeks in a dried up pond. Bullheads reach an average size of six to fourteen inches long. They are omnivorous and will act as scavengers. They feed primarily at night and are easily caught by fishermen using worms for bait. Although their physical appearance is unappetizing, their flesh is exceptionally sweet-tasting and succulent.

The rock bass is not native to this area, but exists here through introductions. There is a healthy population in Granite Lake, and the rock bass at Otter Brook Lake may have descended from fish that migrated downstream. Rock bass inhabit rocky streams and the rocky shores of lakes. They usually are associated with heavy aquatic vegetation. Rock bass have little value as a panfish and can compete with smallmouth bass for food.

Cold Water Fishery

Brook trout (Salvelinus fontinalis) and common shiner are two cold water fish species observed at this reservoir. In the past, the State of New Hampshire has stocked brook trout in Otter Brook both above and below the dam. State fisheries biologists consider Otter Brook to be a good trout brook. This native trout requires cold well-aerated waters to prosper. Temperatures above 68°F are to be avoided. If temperature and oxygen requirements are met, these fish will occupy a wide variety of habitats ranging from swift mountain streams to deep lakes. Naturally occurring populations are supplemented in New Hampshire by stocking. Brook trout spawn in the fall in redds dug out of gravel beds by the females. Brook trout feed mainly on insects.

The common shiner is primarily a stream fish and was found at Otter Brook Lake in locations where Otter Brook flows into the pool. It spawns in late spring and early summer and feeds on insects and microscopic plants and animals. It serves as a forage fish and is our major bait minnow.

Aquatic Furbearers

Aquatic furbearers to be found at this reservoir include muskrats (Ondatra zibethica), beavers (Castor canadensis), and mink (Mustela vison). No otter (Lutra canadensis) have been seen at this reservoir, although otter sightings and signs have been seen both upstream and downstream of the area. The beavers live in bank burrows at the present time and are not maintaining any dams.

Waterfowl and Shorebirds

Various waterfowl and shorebird species have been seen utilizing the reservoir area. Among these species are double-crested cormorant (Phalacrocorax auritus), black duck (Anas rubripes), wood duck (Aix sponsa), Canada goose (Branta canadensis), pied-billed grege (Podilymbus p. podiceps), great blue heron (Ardea herodias), green heron (Butorides v. virescens), killdeer (Charadrius v. vociferus), mallard (Anas p. platyrhynchos), American merganser (Mergus merganser americanus), spotted sandpiper (Agelaius phoeniceus), eastern belted kingfisher (Megaceryle a. alcyon), and osprey (Pandion haliaetus carolinensis).

No data is available on extent of use of this reservoir by any avian species.

Water Quality

The NED Water Quality Laboratory has been collecting data at one inflow station on Otter Brook, one inflow station on Ferry Brook, one interior station at the beach, five pool stations, and one outflow station. Parameters include air and water temperatures, conductivity, dissolved oxygen, pH, and turbidity plus numerous metals and elements.

A complete printout of actual data is available from the NED Water Quality Laboratory. Detailed water quality data shall be consulted before making any extensive changes in habitat or species management programs.

Reservoir Clearing

All trees in the area covered by the permanent pool were removed before storage of the original pool waters. Other open areas in the reservoir were formerly farmland.

Aquatic Vegetation

No vegetative studies have been made in the aquatic environment at this reservoir. Maintenance of a variety of shoreline and lacustrine vegetation would benefit many aquatic wildlife species.

Commercial Fishing

Otter Brook Lake supports no commercial fishing operations at this time. Because of the small size of the permanent pool (90 acres), a commercial fishing operation is not practical.

Water Level Fluctuations

Water level fluctuations can be both detrimental and beneficial to the aquatic environment with the extent of damage depending on many factors -- such as, the time of year, the amount of fluctuation, and the direction of fluctuation (a raising or a lowering of the pool level).

Pool fluctuations can be beneficial when controlled. The water level can be fluctuated to flood an area for the spawning of a desired fish species or to supply a feeding or nesting area for waterfowl. The water level can also be lowered to destroy the spawning of an undesired fish species.

Otter Brook Lake's pool is controlled by three 2' 6" x 4' 6" gates. The permanent pool is maintained at approximately 18 feet by a concrete weir located upstream of the center gate. The weir helps to minimize day-to-day fluctuations. Minimizing daily changes in the water level should rate a high priority along with minimizing any drastic water level changes due to their effect on the aquatic community.

A winter pool is maintained approximately at the 20 foot level to keep the gates from freezing.

Water level fluctuations are unavoidable at flood control dams. Exact figures on pool fluctuations for Otter Brook Lake are available at the project office. These data should be consulted when considering management practices which could be affected by water level fluctuations.

Presently, Otter Brook Lake is being studied for potential hydroelectric production.

Habitat Maintenance and Enhancement

Only two aquatic habitat management programs have been implemented at this reservoir up to 1982. These two programs were the installation of artificial fish reefs and the installation of artificial nesting cavities. Both programs were implemented in the summer of 1979. Each reef consists of seven tires wired together to form a flat-topped pyramid. Seven reefs were sunk in an area on the west side of the pool about 1/4 of the distance between the dam and the beach.

Twelve artificial nesting cavities were installed along the west shore of the pool. These boxes were erected to benefit wood ducks.

Creel Census, Bag Check, and Trapping Report

These three surveys sample the consumptive pressure on the fishery resource, the waterfowl and shorebird resource, and the aquatic furbearer resource, respectively. All three surveys can provide data on population balance and dynamics and establish a basis for the formulation of and the evaluation of future management programs.

No creel census or bag check surveys have been conducted at this reservoir up to 1982.

Trapping reports have been used at this reservoir since the 1979-80 trapping season and have been required of each trapping permittee since the 1981-82 season. Trapping data are summarized in Table 5 (Exhibit A).

Sport Fishing, Hunting, and Trapping

No data are available to assess the fishing pressure or the waterfowl hunting pressure. Chain pickerel, brown bullhead, and yellow perch seem to be the most fished for species.

From the 1974-75 through the 1981-82 trapping seasons, only five trapping permits were issued. Only one permit was issued in any season. Beginning with the 1982-83 season, Otter Brook Lake will be divided into two trapping zones (see Exhibit B). Only one permit will be issued per season for each zone, and permits will be issued through a lottery system.

SECTION 6. TERRESTRIAL WILDLIFE RESOURCES

General

Management of the terrestrial wildlife resources begins with the recognition of the indigenous species to be managed for. Management practices beneficial to a listed species will also benefit many other wildlife species. Before the implementation of any management techniques, consideration will be given to the effects of the techniques upon other indigenous wildlife species.

Major Species

The following is a partial list of indigenous terrestrial wildlife species for which management practices may be implemented:

<u>Common Name</u>	<u>Scientific Name</u>
Black-capped Chickadee	<u>Parus atricapillus</u>
Broad-winged Hawk	<u>Buteo p. platypterus</u>
Eastern Bluebird	<u>Sialia sialis</u>
Eastern Chipmunk	<u>Tamias striatus</u>
Eastern Gray Squirrel	<u>Sciurus carolinensis</u>
Fisher	<u>Martes pennanti</u>
Gray Fox	<u>Urocyon cinereoargenteus</u>
Kestrel	<u>Falco sparverius</u>
New England Cottontail	<u>Sylvilagus transitionalis</u>
Raccoon	<u>Procyon lotor</u>
Red Fox	<u>Vulpes fulva</u>
Red Squirrel	<u>Tamiasciurus hudsonicus</u>
Red-tailed Hawk	<u>Buteo jamaicensis</u>
Ruffed Grouse	<u>Bonasa umbellus</u>
Snowshoe Hare	<u>Lepus americanus</u>
Tree Swallow	<u>Iridoprocne bicolor</u>
Whitetail Deer	<u>Odocoileus virginianus</u>
Wild Turkey	<u>Meleagris gallopavo</u>
Woodcock	<u>Philohela minor</u>

Land Management Practices

All species have basic needs which must be filled by their environment or habitat. These needs include the primary requirements of food, water, and shelter in adequate quantity and quality. Many species also need escape cover to elude predators. Several species have rather specific habitat requirements for breeding and propagation. Some examples are drumming sites for ruffed grouse, suitable den trees for raccoons or pileated woodpeckers (Hylatomus pileatus), and flood proof and relatively predator-proof nesting sites for waterfowl. Each particular species must find all of its daily needs within the immediate range of its daily activity patterns. In general, the greater

the interspersation of cover types providing the basic needs, the better the habitat for that species.

Currently, New Hampshire is 89% forested. Many of the indigneous wildlife species depend on openings and the ecotone between forest and fields. With the extensive woodlands, maintaining the fields and forest openings are important to increase the diversity of habitat types for wildlife.

Mature conifer stands are essential for wintering whitetail deer. Other forest wildlife species depend on various stages of forest succession and mixture.

Adequacy of Lands Allocated to Wildlife

A total of 400 acres are designated for wildlife management. This acreage is adequate for the continued presence of the wildlife species indigenous to the reservoir lands.

Habitat Maintenance and Enhancement

Past habitat management programs have been limited to erecting artificial nesting cavities, thinning to enhance certain habitat types, and pruning and releasing wild apple trees. The cavities were erected in 1978 and 1979. The thinning program has been on-going. The apple tree program was limited to 1979. See the wildlife management map in Exhibit B for general locations of past habitat work.

SECTION 7. ENDANGERED, THREATENED, AND RARE SPECIES

General

The balance of nature is a complicated and delicate system which is poorly understood. Flora and fauna are the barometers by which man can gauge the impact of his civilization on nature; therefore, it is important to monitor the status of a natural community by observing endangered, threatened, and rare species. It is equally important to avoid placing additional stress on these species.

Endangered, threatened, and rare species of flora and fauna in New Hampshire are listed in Table 6 (Exhibit A).

Flora

At present, no plant species list is available for Otter Brook Lake. The reservoir area may support some endangered species. As funding and personnel become available, an inventory of plant species will be made to ensure that any endangered species are identified and mapped.

Fauna

Otter Brook Lake has been used by osprey (Pandion haliaetus) for feeding, but no nest has been found on reservoir lands.

If a rare, threatened, or endangered species is found at Otter Brook Lake, management techniques will be followed to help ensure the species continued survival and reproduction.

SECTION 8. ECOLOGIC RELATIONSHIPS AND IMPACTS

General

Impacts that alter an environment may be natural or man-made. Noticeable natural impacts can be severe (such as hurricane blowdowns) and can level mature stands of trees or ruin habitat needed by wildlife species for survival. One difference between natural and man caused impacts is that impacts caused by man can be controlled and can, therefore, be lessened or eliminated.

Soil Erosion

Sediment is the greatest pollutant by volume, but the amount of sediment entering a stretch of stream can be minimized through various management practices. Erosion along a riverbank may seem to cover a small area, but almost 100 percent of the eroded soil enters the river since there is no chance for it to be trapped or filtered out. Sediment covers fish spawning beds, suffocates the sensitive eggs of game fish, covers food organisms relied upon by some fish species, and causes mechanical injury to the gills of fish. Sediment also raises the water's turbidity, which reduces light penetration for photosynthesis and, thus, reduces dissolved oxygen levels.

Streambank erosion has occurred at a few sites along Otter Brook and have been allowed to stabilize naturally. This process is usually very slow.

Inundation of Forest Stands

Considerable mortality of tree species can take place in areas of frequent inundation. Mortality rates are higher when impoundments occur during the growing season. Impoundments at other times of the year are generally not harmful to trees except for mechanical damage caused by ice. The primary causes of mortality are damage to root structures and siltation of leaf parts upsetting normal transpiration and photosynthesis.

Due to mortality from frequent inundation, the cover type adjacent to the pool is changing from forests to open lands or a more flood tolerant species of tree.

The impact on vegetation caused by the regulation and impoundment of water at six New England flood control reservoirs during the June-July 1973 flood was assessed using color infrared photography and corroborative ground surveys. The results were published in the U.S. Army Cold Regions Research and Engineering Laboratory's Special Report 220, "Inundation Damage to Vegetation at Selected New England Flood Control Reservoirs," March, 1975.

Natural Resources Management

The implementation of this natural resources management plan will alter some areas of habitat at Otter Brook Lake. Some fields will be burned, plowed, and planted. The pool level regimen will be altered and some vegetation patterns will be changed. These changes are intended to benefit the natural environment. They are based on an overall view of the project resources with the ecological relationships of the different habitat types considered as an overriding factor.

An Environmental Assessment of the Operation and Maintenance of Otter Brook Lake was published in October 1973.

Fire

Forest fires can destroy recreational facilities, wildlife habitat, and the forest ecotone. A sound resource management program must include a fire protection plan to help conserve the natural resources. Details of this plan can be found in Appendix C (Fire Protection Plan) of the master plan.

SECTION 9. OUTGRANTS

The only outgrant at Otter Brook Lake is an easement to the Town of Roxbury, New Hampshire, for a right-of-way for the maintenance and operation of the relocated Davis Road.

With the exception of concessions, no other outgrants will be granted at this reservoir.

SECTION 10. DISEASES, POLLUTION, AND OTHER ADVERSE EFFECTS

Wildlife Diseases

Although no evidence of wildlife disease is apparent, this does not preclude the presence of a disease. If an animal is observed displaying unusual behavior, the local game warden should be contacted. All natural wildlife mortality found on reservoir lands will be inspected in an attempt to determine probable cause of death and possible presence of any diseases.

Tree Diseases

Beech bark disease, white pine blister rust, sugar maple dieback, and yellow birch rot are present but do not appear to be causing extensive mortality. The forest stands will be checked for increased infestations of any disease. See Table 7 (Exhibit A) for spatial distribution data.

Insects

White pine weevils (Pissodes strobi) have attacked white pines throughout the reservoir area. Damage is evident by the multiple-stem pines seen in the area. Artificial control of the white pine weevil is uneconomical, but natural control may be achieved through selective cutting practices to maintain or establish mixed stands of white pine and native hardwoods.

Gypsy moths (Porthetria dispar) infest various portions of this reservoir. Although control of gypsy moth on forest land is expensive and may not be justified in certain areas, control should be attempted where feasible when outbreaks occur. Control methods will include applications of Bacillus thuringiensis and releases of parasitic insects such as Oencyrus kuwanae and predatory insects such as Calosoma beetles.

Woolly beech scale (Cryptococcus fagi), red oak borer (Enaphalodes rufulus), tent caterpillars (Malacosoma spp.), fall webworms (Hyphantria cunea), and hemlock looper have been identified but are posing no problem as of 1981.

See Table 7 (Exhibit A) for spatial distribution data.

Air Pollution

Although no large industrial centers exist in the Otter Brook Lake area, the effects of industrial emissions from other regions of the country are being realized in the form of acid rain. Emissions containing nitrous and sulfurous oxides are carried with the prevailing winds to be released with rain as nitric and sulfuric acids. The resultant acidification of surface water has rendered some lacustrine systems lifeless. Management efforts should include a history of the waters pH in the project.

Pesticides

Pesticide use has been confined to the application of herbicides to the rock slopes of the dam. The herbicides are applied during the growing season to discourage plant growth on the rock slopes. The herbicides used primarily are Banvel, Simazine, Trimec, and 2, 4-D. Use has been confined to the registered application rates. Not all types were used each year.

SECTION 11. MANAGEMENT PROGRAMS

Forestry

General

Management techniques implemented on forested land will, to various extents, affect the major terrestrial wildlife species listed in Section 6. Many non-listed species will also be affected.

Short-Range Programs (up to 1987)

A resource mapdown will be conducted before 1985. Data from this survey will be used to set up harvest cuts and timber stand improvement programs through 1987.

A timber sale will be set up during 1982, although the sale may not take place until 1983. The site will be at the north end of compartment 2.

Long-Range Programs

Maintenance of the whitetail deer wintering area (see Exhibit B) is a program of high priority. Any timber harvest in the wintering area will be set up to ensure that at least 50 percent of the softwood cover remains. No new recreational developments, including trails, will be planned or constructed in this wintering area.

Fish and Wildlife Management

General

Habitat requirements critical to species survival will be identified and managed. Emphasis will be placed on habitat enhancement techniques that key on the limiting habitat condition. Habitat enhancement beneficial to the wildlife community will also benefit the public by providing additional recreational opportunities for wildlife-human contacts.

Short-Range Programs (up to 1987)

Fish surveys will be conducted to determine species presence and population trends in all waters on the reservoir lands.

Eroded areas will be located and seeded with a conservation mixture. Fertilizer and mulch will be applied as needed.

A lack of suitable nesting cavities exists in many parts of the reservoir. From 1982 through 1986, at least 35 artificial nesting cavities will be installed at various locations throughout the reservoir. These boxes will be built to benefit a number of species and will be sized accordingly.

species that will benefit from these cavities include tree swallow, eastern bluebird, house wren (Troglodytes aedon), black-capped chickadee, kestrel, American merganser, wood duck and gray squirrel. Also, den trees will be saved whenever possible.

To enhance aquatic habitat for aquatic furbearers, waterfowl, and shorebirds, the wetland area south of the downstream bridge in the recreation area will be managed by the rehabilitation of the culvert bringing water from Otter Brook to the upper end of the wetland area and by the installation of a water control structure at the lower end of the wetland area to maintain and control the water level at one to two feet higher than the present level. Work will commence in 1983.

From 1982 to 1986, an average of eight tire reefs per year will be placed at selected sites in the main pool. These artificial reefs will provide additional cover for various fish species.

A stream improvement plan will be prepared for the portion of Ferry Brook on reservoir lands. This plan will be ready by the end of 1986.

Long-Range Programs

Practices to be used to enhance the river and streams for trout will include maintaining and enhancing wooded banks to provide shade and food (insects dropping into the water), maintaining streambank vegetation to control erosion and keep sediment out of the water, and maintaining adequate and suitable spawning areas for the managed species.

When timber cuts are made, some slash will be piled on and around stumps to provide cover for small mammals. Piling of slash will be determined by the pool stage at which the area will become inundated, proximity to the river, fire hazard, the need for small mammal cover, and other factors.

The wild turkey habitat management program will continue through plantings in open areas and through creating openings in the forested area of the reservoir. Species to be planted will include barberry (Berberis spp.), crabapple (Malus spp.), autumn olive (Elaeagnus umbellata), cranberry viburnum (Viburnum trilobum), and winterberry (Ilex spp.).

Apple trees will be located and mapped. Pruning and releasing will be accomplished as needed.

Prescribed burns will be used to enhance wildlife habitat, to improve the yield and quality of forage, to modify vegetative species composition, to reduce wildfire hazards, to expose mineral soil for seedbeds, and to control insects and disease. Prescribed burns will be set up and conducted by the basin park rangers.

All forest openings and old fields will be maintained in an early successional stage. These open lands will be monitored by the basin park

rangers, and the rangers will recommend burning, brushing-out, or mowing at specific times. The extent of work will be specified before implementation of the recommended practice. Generally, old fields will not be reforested, although clumps or hedges or trees and shrubs may be planted to enhance food and cover availability in an area.

To enhance whitetail deer habitat, the wintering area on government land will be maintained. No heavy timber cuts will be allowed in softwoods that provide winter shelter for deer, and developments will not be planned for the deer wintering area. Any cutting plans will be coordinated with the New Hampshire Department of Fish and Game to ensure that disturbance is minimal. Softwoods and mast-producing trees will be favored during any harvests. Browse species will be favored during any regeneration management in the deer wintering area. See Exhibit B for the location of the whitetail deer wintering area. Other wintering areas may be located during future surveys.

Basin and project personnel will cooperate with applicable state and federal agencies in surveys of fish and wildlife species, habitats, management protection requirements, and reintroduction efforts.

SECTION 12. RESEARCH AND RELATED ACTIVITIES

The following research and related activities are recommended to enhance the natural resources management program:

- a. implement creel census surveys to sample fishing pressure;
- b. assess personnel training needs concerning management of the natural resources;
- c. compile species lists for mammals, birds, reptiles, and amphibians using the reservoir area and for woody and herbaceous flora located on reservoir lands;
- d. investigate alternative methods of vegetation control, and implement such methods to reduce the use of pesticides.

SECTION 13. INFORMATION AND EDUCATION

An information and education (I&E) program is an important aspect of natural resources management. In conjunction with this plan, an I&E program should educate the public about natural resources management and inform them about present and proposed management implementation. The I&E program should be a continual and active program.

Current I&E programs concerning natural resources management involve presentations to school classes, organized groups, and Keene Recreation Department groups by the park rangers and technicians. These presentations are designed to inform and involve the public in natural resources management practices.

The only foreseeable change will be to expand the present I&E program. Areas of expansion could include the establishment of natural resources management demonstration areas and tours, news releases and radio appearances concerning natural resources management programs, and the preparation and distribution of informational materials.

The image and understanding of the Corps natural resources management program will be enhanced by public contacts initiated through an organized and active I&E program. Information about ongoing interpretive programs and guidelines can be found in the Interpretive Management Plan for the Upper Connecticut River Basin.

SECTION 14. LAW ENFORCEMENT

On Corps of Engineers flood control reservoirs, the federal government retains proprietary jurisdiction. All state and local laws are applicable. All harvesting of fish and wildlife species at Otter Brook Lake must be carried out in accordance with state fish and game laws and regulations. Corps personnel are not responsible for directly enforcing the state laws but will cooperate with state and federal law enforcement agencies.

Title 36 will be strictly enforced by Corps personnel, as many sections deal with the protection and management of the natural resources at Corps reservoirs.

SECTION 15. ANNUAL WORK PLAN

General

The annual work plan will establish a schedule of natural resources management operations. The annual work plan will be developed by 1 January of each year. An assessment of the work accomplished under the previous year's annual work plan will be completed by 1 March. Each annual work plan and assessment will be appended to this plan as part of Exhibit D.

Disposal Plan

Where feasible, merchantable timber will be harvested. For each harvest, a separate plan will be prepared in accordance with ER 405-23-912. Location, area, volume, and justification for each harvest will be included in the disposal plan.

EXHIBIT A. TABLES

<u>Table</u>	<u>Title</u>
1	Pool Stage Elevations for Otter Brook Lake
2	Estimated Timber Volume by Species and Cover Type for Otter Brook Lake (Thousand Board Feet -- International 1/4-Inch Rule)
3	Summary of Gill Net Survey in Permanent Pool at Otter Brook Lake, August 1979
4	Summary of Fish Surveys at Otter Brook Lake in 1980 by Gear Type
5	Summary of Trapping Data for Otter Brook Lake
6	Endangered, Threatened, and Rare Species: State and Federal Lists for New Hampshire
7	Spatial Distribution of Tree Diseases and Insect Pests at Otter Brook Lake

TABLE 1. POOL STAGE ELEVATIONS FOR OTTER BROOK LAKE

<u>Pool</u>	<u>Elevation NGVD</u>	<u>Stage (ft.)</u>	<u>Area (Ac.)</u>
Permanent	701	18	90
Spillway	781	98	374
Maximum Surcharge	797	114	

TABLE 2. ESTIMATED TIMBER VOLUME BY SPECIES AND COVER TYPE FOR OTTER BROOK LAKE
(THOUSAND BOARD FEET -- INTERNATIONAL 1/4-INCH RULE)

<u>Species</u>	<u>Cover Types</u>						<u>Totals</u>
	<u>20-3-A</u>	<u>21-4-A</u>	<u>21-3-C</u> <u>23-2-A</u>	<u>23-3-A</u>	<u>25-3-A</u>	<u>54-6</u>	
Apple			8.5				8.5
White Ash					4.4		4.4
American Beech				9.1	7.4		16.5
Eastern Hemlock	89.5	11.3	96.3	561.1	22.6		780.8
Red Maple	12.5	24.4		37.7	75.5		150.1
Sugar Maple					57.4		57.4
Northern Red Oak	71.1			60.1	58.6	14.0	203.8
Eastern White Pine	<u>89.5</u>	<u>780.4</u>	<u>111.8</u>	<u>20.2</u>	<u>43.9</u>	<u> </u>	<u>1,045.8</u>
Totals	262.6	816.1	216.6	688.2	269.8	14.0	2,267.3

TABLE 3. SUMMARY OF GILL NET SURVEY IN PERMANENT POOL AT
OTTER BROOK LAKE, AUGUST 1979

<u>Species</u>	<u>No. Caught</u>	<u>% Total</u>
Chain Pickerel	38	51.4
Brown Bullhead	21	28.4
Yellow Perch	10	13.5
Golden Shiner	2	2.7
Sunfish	1	1.4
White Sucker	1	1.4
Fallfish	<u>1</u>	<u>1.4</u>
TOTALS	74	100.2

TABLE 4. SUMMARY OF FISH SURVEYS AT OTTER BROOK LAKE IN 1980 BY GEAR TYPE

Species	Minnow Trap		Trap Net		Gill Net (2")		Gill Net (1")	
	No.	% Total	No.	% Total	No.	% Total	No.	% Total
Chain Pickerel	--	----	18	62.1	29	37.2	14	8.6
Yellow Perch	34	49.3	8	27.6	6	7.7	54	33.3
Golden Shiner	24	34.8	--	----	--	----	58	35.8
Fallfish	4	5.8	1	3.4	4	5.1	21	13.0
Pumpkinseed	7	10.1	--	----	10	12.8	2	1.2
White Sucker	--	----	1	3.4	23	29.5	--	----
Rock Bass	--	----	1	3.4	1	1.3	--	----
Brown Bullhead	--	----	--	----	5	6.4	--	----
Common Shiner	--	----	--	----	--	----	13	8.0
TOTALS	69	100.0	29	99.9	78	100.0	162	99.9

TABLE 5. SUMMARY OF TRAPPING DATA FOR OTTER BROOK LAKE

<u>Season</u>	<u>No. Permits Issued</u>	<u>No. Reports Turned In</u>	<u>No. Trapping Days</u>	<u>No. Caught By Beaver</u>	<u>Species Red Fox</u>
1974-75	0	<u>A/</u>	----	-	-
1975-76	1	<u>A/</u>	----	5	-
1976-77	1	<u>A/</u>	----	-	-
1977-78	0	<u>A/</u>	----	-	-
1978-79	0	<u>A/</u>	----	-	-
1979-80	1	1	360	-	3
1980-81	1	0	----	-	-
1981-82	1	<u>B/</u>	----	-	-

A/ not in use

B/ season not over as of date of data compilation

TABLE 6. ENDANGERED, THREATENED, AND REAR SPECIES:
STATE AND FEDERAL LISTS FOR NEW HAMPSHIRE

State List - Fauna

<u>Common Name</u>	<u>Scientific Name</u>
<u>Endangered</u>	
Bald Eagle	<u>Haliaeetus l. leucocephalus</u>
Indian Bat	<u>Myotis sodalis</u>
Lynx	<u>Lynx canadensis</u>
Peregrine	<u>Falco peregrinus anatum</u>
Short Nose Sturgeon	<u>Acipenser brevirostrus</u>
Sunapee Trout	<u>Salvelinus aureolus</u>
<u>Threatened</u>	
Artic Tern	<u>Sterna paradisaea</u>
Common Loon	<u>Gavia immer</u>
Common Tern	<u>Sterna h. hirundo</u>
Cooper's Hawk	<u>Accipiter cooperii</u>
Eastern Bluebird	<u>Sialia sialis</u>
Marsh Hawk	<u>Circus cyaneus hudsonius</u>
Osprey	<u>Pandion haliaetus</u>
Pine Marten	<u>Martes americana</u>
Purple Martin	<u>Progne s. subis</u>
Red-shouldered Hawk	<u>Buteo lineatus</u>
Roseate Tern	<u>Sterna d. dougallii</u>
Upland Sandpiper	<u>Bartramia longicauda</u>
Whip-poor-will	<u>Caprimulgus vociferus</u>
<u>Extirpated</u>	
Black-crowned Night Heron	<u>Nycticorax nycticorax hoactli</u>
Cougar	<u>Felis concolor cougar</u>
Gray Wolf	<u>Canis lupus</u>
Least Tern	<u>Sterna albifrons</u>
Loggerhead Shrike	<u>Lanius ludovicianus</u>
Northern Bog Lemming	<u>Synaptomys borealis</u>
Piping Plover	<u>Charadrius melodus</u>
<u>Extirpated - Restoration Underway</u>	
American Shad	<u>Alosa sapidissima</u>
Atlantic Salmon	<u>Salmo salar</u>

State List - Fauna (cont.)

Common Name

Scientific Name

Special Concern - Rare

Black-backed Three-toed Woodpecker
Black Rat Snake
Blanding's Turtle
Box Turtle
Eastern Pipistrel
Four-toed Salamander
Golden-winged Warbler
Grasshopper Sparrow
Gray Jay
Henslow's Sparrow
Jefferson Salamander
Keen Myotis
Least Bittern
Mudpuppy
New England Cottontail
Northern Three-toed Woodpecker
Pied-billed Grebe
Rusty Blackbird
Screech Owl
Short-billed Marsh Wren
Slimy Salamander
Small-footed Myotis
Sora
Southern Bog Lemming
Spring Salamander
Yellownose Vole

Picoides arcticus
Elaphe o. obsoleta
Emydoidea blandingi
Terrapene c. carolina
Pipistrellus subflavus
Hemidactylium scutatum
Vermivora chrysoptera
Ammodramus savannarum
Perisoreus canadensis
Passerherbulus henslowii
Ambystoma jeffersonianum
Myotis keeni
Ixobrychus e. exilis
Necturus maculosus
Sylvilagus transitionalis
Picoides tridactylus bacatus
Podilymbus p. podiceps
Euphagus carolinus
Otus asio
Cistothorus platensis stellaris
Plethodon g. glutinosus
Myotis subulatus
Porzana carolina
Synaptomys cooperi
Gyrinophilus porphyriticus
Microtus chrotorrhinus

Special Concern - Status Undetermined

Atlantic Sturgeon
Bobcat
Cliff Swallow
Common Nighthawk
Finescale Dace
Golden Eagle
Long-eared Owl
Longtail Shrew
Marbled Salamander
Pygmy Shrew
Short-eared Owl
Timber Rattlesnake
Vesper Sparrow
Wood Turtle

Acipenser oxyrhynchus
Lynx rufus
Petrochelidon pyrrhonota albifrons
Chordeiles minor
Phoxinus neogaeus
Aquila chrysaetos canadensis
Asio otus wilsonianus
Sorex dispar
Ambystoma opacum
Microsorex hoyi
Asio f. flammeus
Crotalus h. horridus
Poaeetes g. gramineus
Clemmys insculpta

TABLE 7. SPATIAL DISTRIBUTION OF TREE DISEASES AND INSECT PESTS
AT OTTER BROOK LAKE 1/

<u>Disease or Insect</u>	<u>No. Plots Occupied</u>	<u>Frequency Percent</u>
Beech Bark Disease	1	5.9
White Pine Blister Rust	1	5.9
Sugar Maple Cankers	1	5.9
Maple Dieback	1	5.9
Yellow Birch Rot	1	5.9
Gypsy Moth	12	70.6
Hemlock Looper	2	11.8
White Pine Weevil	9	52.9
Woolly Beech Scale	1	5.9
Red Oak Borer	1	5.9

1/ Data gathered during December 1981 and January 1982 on 17 plots.

EXHIBIT B. MAPS

Map

Title

1

Forest Compartments and Cover Types

2

Wildlife Management

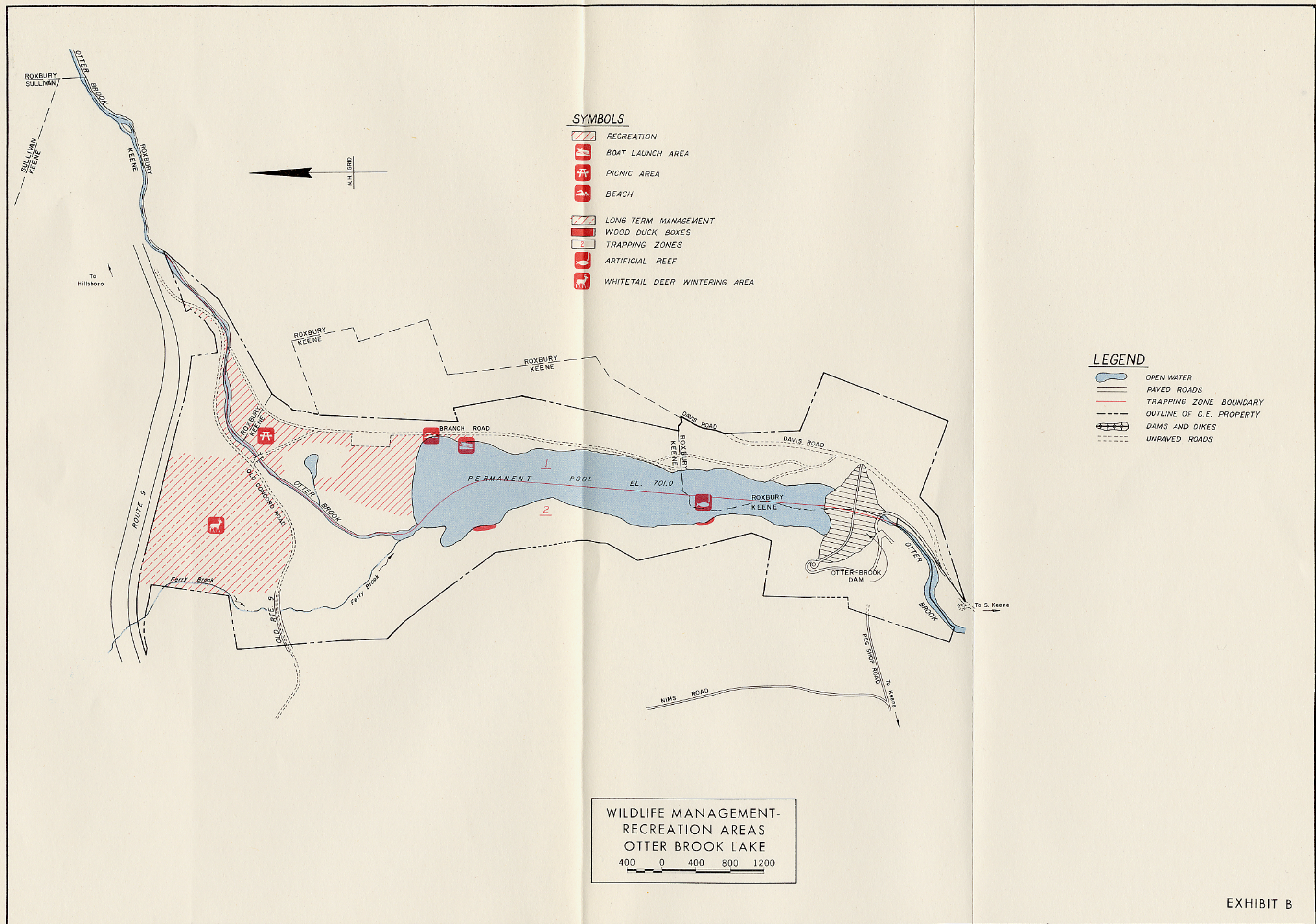


EXHIBIT C. ANNUAL WORK PLANS AND ASSESSMENT

NATURAL RESOURCES MANAGEMENT
OTTER BROOK LAKE
ANNUAL WORK PLAN -- 1981

Construct and Install Tire Reefs

Timber Cruise

Thin -- Ferry Brook area (wildlife habitat enhancement)

Gillnet Survey

Thin -- along access road (wildlife habitat enhancement)